

Implementation of green productivity management in airline industry

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ABSTRACT: Compilation and implementation of green productivity mechanism in each governmental and non-governmental organization has several environmental, social and economic achievements. In this paper for management of green productivity in Iran Aseman Airline Company current situation are analyzed such as the consumption of energy, water, airplanes fuel and evaluating environmental pollutants. At the end of this study some applicable techniques for increasing the productivity and consideration of environmental aspects in this company are recommended. Maximum water consumption had been 7500 m³ in the year 2005 during August until September, the maximum of electricity consumption was 759300 kWh in the year 2004 during July until August, the maximum of natural gas consumption had been 83647 m³ in the year 2004 during Feb until March, Also averages of 661500 L of fuel were consumed in this company's vehicles yearly and in the last nine month of the year 2005, amount of 60263155 liters of airplane fuel has been consumed.

Key words: *Green productivity, energy, aviation industry, Aseman Airline*

INTRODUCTION

Access to the goals of sustainable development would emphasize the necessity of carefulness in consumption of natural resources. Thus, it is necessary to provide and compile of bases and principles of green business, green productivity and green government in order to economize in limited resources rationally and to retain natural resources for next generations (Pineda, 2004). Therefore, this has been examined in article 66 of 4th 5 year development plan. In association to the mentioned matter, enforcing green management program in organizations for decreasing current costs and establishment of environmental management system in organizations as green management are leading proposals that have been mentioned in Article 66 of 4th 5 year development plan but acquiring sustainable development goals requires more serious attempt. It has been noted in article 66 of 4th 5 year development plan that all of the executive organizations and institutes and non-governmental organizations have to perform their operation in parallel to decrease public cost credits, using optimal consumption policies of primary resources and environmental, for enforcing green management program including energy consumption management, water,

primary materials and equipment (including paper), reducing solid waste and recycling them (in buildings and vehicles) according to the regulations that will be provided by Department of the Environment and the related organizations and will be approved by ministerial board. Furthermore, green government system has emphasized an optimal economy of resources and its desire is toward decreasing consumptions and excessive costs and losses in the areas related to energy conveyers consumptions, water, paper and other materials and energy items which must be performed by organizations and companies with regard to increasing needs of the society (Iran Expertise Group, 2003).

Along with the above mentioned matters, aviation industry and airplane companies are one of the most important consuming parts of resources and energy in each country. Aviation is consumer of non-renewable resources and it causes local and world wide climate changes and creates Noise pollution but has an important and valuable share in the execution of sustainable development in all over the world (Meredith, 2005), Aseman Airplane Company is also one of the most active Iranian airlines company in which, attention to environmental subjects has been regarded along with other aims of company. Therefore, it is hoped that

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rendering this research would be an area of establishment of environmental management and increment of green productivity in Aseman Airline Company. This paper has been done in Tehran in Iran Aseman Airline Company from November -June, 2005.

MATERIALS AND METHODS

In this research, library studies, internet searches and field study have been used for collecting information and collecting devices are check list and questionnaire. In current research, firstly definitions and generalities have been collected by means of librarian studies and internet searches and then, statistical information related to current situation of Aseman Airline company regarding to the amount of water, energy, paper and energy items consumption, airplane and vehicle fuel by using of field study and performed interviews and information related to environmental pollutants has been collected by means of field visits and completing questionnaire and information analysis has been performed by means of grouping information, checklists analysis, statistic information analysis and outline of figures with excel software.

RESULTS

Water consumption

Aviation industry has been one of the growing industries during recent decades. Although, this industry has minimum share in water consumption,

but it is necessary to inspect water consumption trend in this company in order to reach to the green productivity and its compilation. (Kim and Hur, 2004). In general, water is consumed for drinking, green space irrigation and cooling appliances in Aseman Airplane Company. Water consumption has been in ascending trend from the June of 2003 and maximum water consumption has occurred during August until September. Water consumption increase has been in virtue of warm weather, such as drinkable water, irrigation of green space and usage of cooler and other cooling appliances. (Fig. 1) Water consumption has been in ascending trend from March 2004 until last days of July and its maximum has been during July. The reason for increasing consumption has been mentioned previously and the reason for intense fall of water consumption in comparison to the year before has been import of water share from neighborhood industries and therefore, water consumption of the company has been represented less than before (Fig. 2). the amount of water consumption has been in ascending trend during May of 2005 until September 2005 and after this period, has been in descending trend. Maximum consumption has been in amount of 7500 cubic meters during August until September and its reason has been increment of Air temperature (Fig. 3). Examining the checklist of water consumption in Aseman Airlines shows that company has good condition in water consumption.

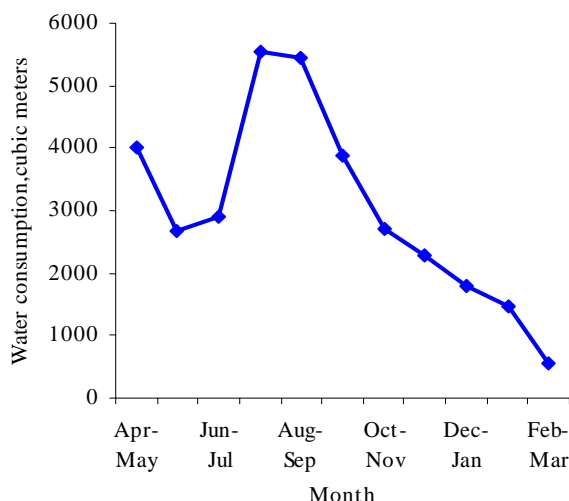


Fig. 1: Amount of water consumption according to cubic meter in Aseman Airline during 2003-2004

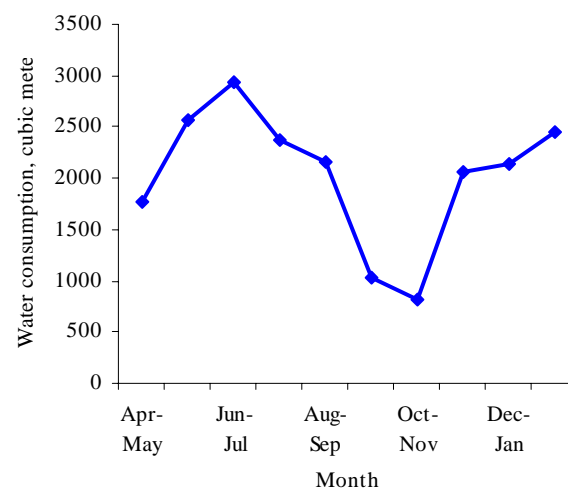


Fig. 2: Amount of water consumption according to cubic meter in Aseman Airline in 2004-2005

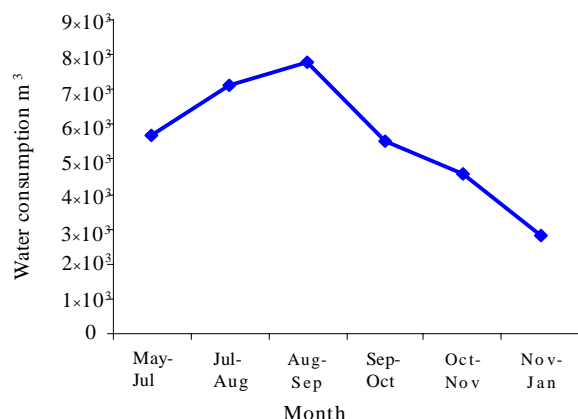


Fig. 3: Amount of water consumption according to cubic meter in Aseman Airline in 2005-2006

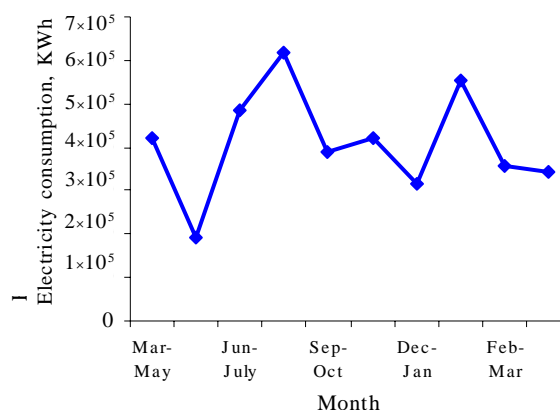


Fig. 4: Amount of electricity consumption according to kWh in Aseman Airline in 2003-2004

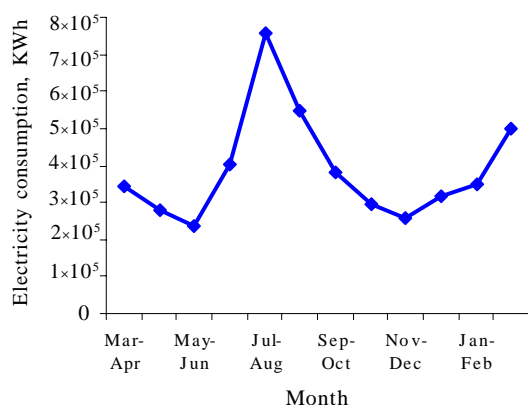


Fig. 5: Amount of electricity consumption according to kWh in Aseman Airline in 2004-2005

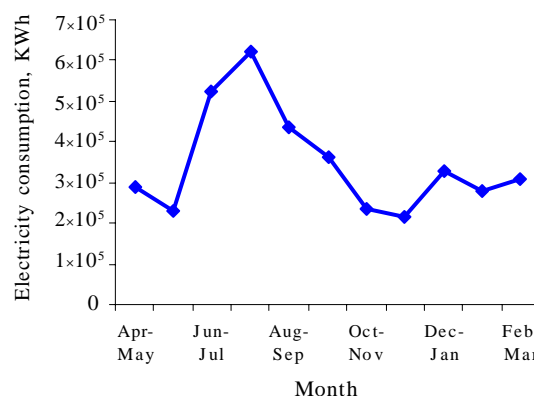


Fig. 6: Amount of electricity consumption according to kWh in Aseman Airline in 2005-2006

Electricity consumption

Central heating system is used in the most parts of this county in order to provide heating condition and some buildings also have fan coil. Many buildings of this company are equipped with water cooler in order to provide cooling condition and fan coil in used in some buildings. Fig. 4 shows electricity consumption trend in Aseman Airline. This figure has two peaks. First peak shows the maximum electricity consumption in 2003 which is related to the months from July until September and amount of electricity consumption has been 619600 kWh during this period. Main reason of this consumption has increase of electricity consumption during warm weather and usage of cooling appliances such as chiller and cooler. Second peak has been on January in 2004. Amount of electricity

consumption has been 5536000 kWh in this month .Main reason is the usage of heating electricity consumption has increased about 580000 kWh in 2004 but figure of consumption shows a Procedure like the year 2003 and peak of consumption has been 759300 kWh during July until August (Fig. 5). Regarding Fig. 6, the maximum electricity consumption has been 622400 kWh during July until August of 2005 that is result of using cooling appliances. Second peak in this year has been 330400 kWh during December of the year 2005 until January of the year 2006 that is because of using cooling appliances. But, altogether, the amount of consumption has decreased in comparison with years before. Inspecting checklists also shows that among sum of 23 questions” 15 questions have been about

correct way of electricity consumption and therefore, 65 percentage results of measurement shows that this company has suitable situation in terms of energy consumption, But, according to negative responses and rendering necessary arrangements, company condition may be promoted to the best level of productivity, and hope to shift reducing electrical energy consumption.

Natural gas consumption

According to Fig. 7, it is observed that natural gas consumption has been in descending trend during September until February so that peak of consumption has occurred during December until January and amount of this consumption is 63490 cubic meters during this period. The reason for ascending of natural gas consumption in September may be using Just for cooking in and some subsidiary works during April until October but since October, heating devices also use gas and therefore, natural gas consumption would be in ascending trend in comparison with months before. Fig. 8 Shows natural gas consumption trend of Aseman Airline in the year 2004.

This Fig. has descending trend from beginning of the year until the last days of September and then, from September until the end of the year has been in ascending trend and peak of consumption has occurred from February until March and this peak point has been 83647 cubic meters which shows increment of 72902 cubic meters in comparison with the year 2003. Fig. 9 shows natural gas consumption trend of Aseman Airline in the year 2005 and according to this figure, amount of consumption has been 75884 cubic meters during months of December until January.

Paper consumption and other materials and energy items

Paper is the most important materials, because primary materials of paper namely trees are of the important resources of Ecological element in the earth. We should consider that reusing of discarded papers may be one of the most important and common issues of recycling aspects. In other words, it may be emphasized that by reusing of paper and its restoration, 114 trees may be retained in lieu of each metric ton of paper. (Iran expertise group, 2003), 70 packages of hand tissue and toilet tissue are consumed daily in Aseman Airline that price of each package of hand tissue 0.27 dollar and price of each package of toilet hand tissue is

0.43 dollar. In general, the cost of buying hand tissue in each month is 15000 dollar in this company. To consider every mount the consumption of A4 printing paper is 2000 packages, each package including 500 sheets in the size of A4, the price of each package is 4.3 dollar which means 8800 dollar monthly. According to above mentioned calculations, it is observed that high costs are allocated to buying paper and paper tissue. Deployment of simple procedures can reduce this amount and increase Company's productivity.

E-Solid wastes:

Different kinds of waste have been always a problem in different societies and still, this problem exists in many areas (Omran, 1995).

According to increasing growth of aviation industry, management of solid waste is an important element in environmental management of airlines. Significant part of solid waste of aviation industry is the produced solid waste in each flight that its amount has been estimated 500 kilogram for each flight. Large quantity of these materials is related to paper which is newspaper and food menu significantly and is amounted to 32 percent till 71 percent of total solid wastes in this company (Li, *et al.*, 2003).

The origin of waste generation is divided into two parts:

1) General solid waste produced in different parts of the company.

2) Returned solid excessive materials from airplane.

Aseman Airline has a contract with municipality and on the basis of this contract, Aseman Airline collects non recyclable waste such as food waste and accumulates them in a designate place and then, municipality collects garbage from this place. Recyclable garbage has been collected by a company which operates in supervision of Aseman Airline.

Fuel consumption for transportation

About three forth of Tehran city's air pollution is because of transportation and according to statistics in the year 2003, transportation has consumed more than 56; million liter of gasoline. In spite of this consumption, maximum produced power at internal refineries is less than 40 million liter daily, in other word because of irrational consumption of fuel in country, more than 16 million liters of gasoline is imported daily and its costs originate from national incomes. (Green Government Informative Magazine, 2005), It has been consumed an average of 661500 L of fuel during the Amount of fuel consumption has been increased

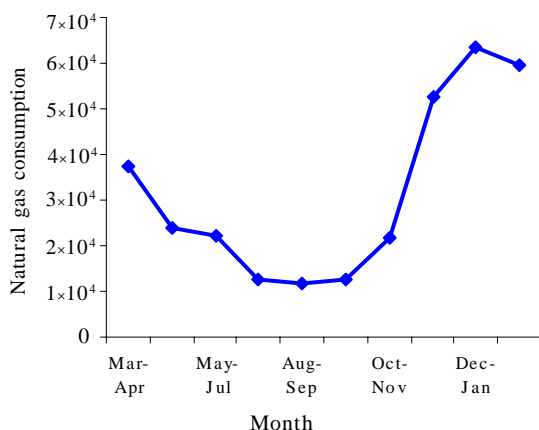


Fig. 7: Amount of gas consumption according to cubic meter in Aseman Airline in 2003-2004

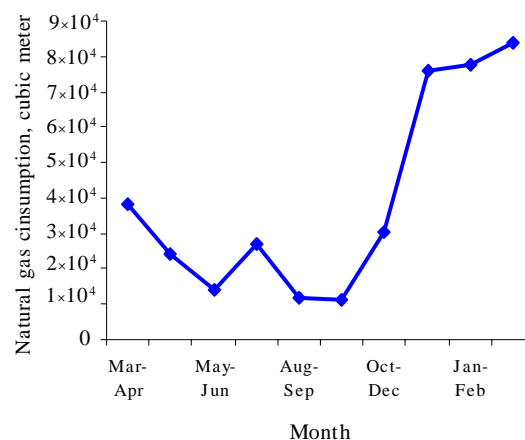


Fig. 8: Amount of gas consumption according to cubic meter in Aseman Airline in 2004-2005

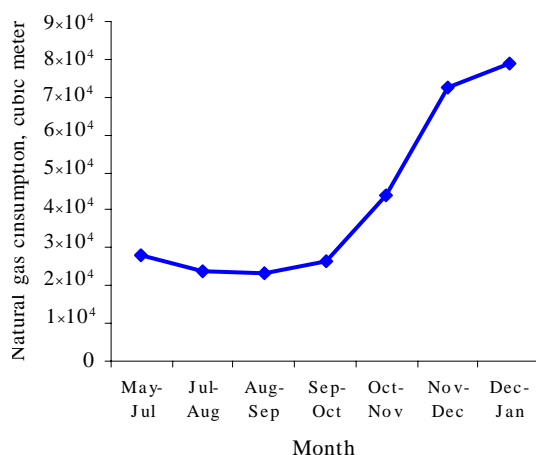


Fig. 9: Amount of Gas consumption according to cubic meter in Aseman Airline in 2005-2006

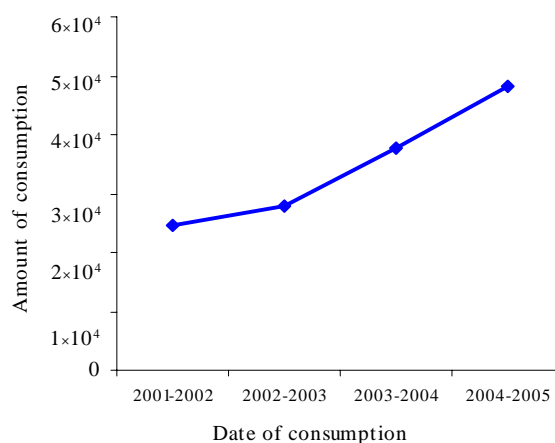


Fig. 10: Amount of airplane fuel consumption according to liter in Aseman Airline in 2001-2005

year 2003 till the year 2005 in Aseman Airline that its cost is equal to 58200 dollar. About 64 percent of vehicles of Aseman Airline are ranked lower than model of the year 1993 and therefore, an action must be performed for replacing them. On the other hand, many vehicles of company, use gasoline as fuel and change of gasoline fueled engines to the natural gas fueled engine, may contribute to the reduction of pollution arising from company vehicles.

5 responses to the 8 questions have been in a positive direction.

Airplane fuel consumption

In general three kind of fuel are used in Iranian Airlines:

1) Turbine fuels: The most common fuels which are used in the Motor of Jet turbine airplanes, such as: A.T.K. or JETA-1 and JP4.

2) Airplane gasoline: a kind of fuel which is used in airplanes equipped with regular Piston engine is Airplane gasoline.

3) Fluids used for increment of engine power: A kind of fuel which is used for flying and landing and acquiring necessary more power. (Jeppesen, 2000), Jeta 1 and JP4 are used as airplane fuel in Aseman Airline. In Fig (10), amount of fuel consumption has been shown during the year 2001 until 2004 in Aseman Airline. As it is seen in the figure, amount of fuel consumption has growing rate in Aseman Airline.

approximately 20,000,000 L each year in comparison with the last year. Although a number of performed flights has been in ascending trend during the year 2001 with 2005, but this incremental amount of fuel consumption is justifiable and therefore it may be possible to reduce fuel consumption by providing perquisite procedures in order to raise productivity in addition to development of flights. Efficient factors in reducing fuel consumption of airlines include:

Aerial Traffic, Airplane weight, distance and flight range, repair and retention of airplane, performance characteristics and flight dynamics, aerodynamics features, fleet renovation. (Schiling, 1997)

Hazardous waste arising from airplane washing

Cleaning motor pieces and frame of airplane is a very sensitive procedure in industry and especially in air transportation industry. Existence of any kind of pollutant and external excessive materials in airplane engine can be reason of reduction of yield in compressor, turbine and other different parts of engine and has a negative effect in amount of repellent force. Therefore, reduction of pollution should be followed by the most suitable and effective ways of selecting special washing material in order to reach to the desirable result and having minimum negative effect. (Wheat, 2003), At present, materials that are used for airplane washing and cleaning in Aseman Airline are significantly dangerous which are bought from Cee-Bee Company. At present, remainder of these materials is discharge to sewage after neutralization. Some of these materials are DiPropylene Glycol methyl Ether, Silicate Sodium, Diethylen Glycol, Mono Butyl Ether, Sodium Hydroxide, Phosphoric acid, etc.

Noise pollution

Airplane sound produces whenever moving along landing strip, whenever take offing and whenever landing. Airplane noise is main problem of residential area around airport to the radial length of 100 kilometers. Commercial aviation has more shares in production of total airplane noise but we can't ignore share of private and military airplanes. Noise arising from airplanes flights may be divided into three general groups: Sound of Turbo jet engine, sound of turbo fan engine and sound of aerodynamics (Department for transport, 2003). Sound of present airplanes fleet has been 20 dB less than sound of airplanes in thirty years before and

equally, it has decreased 75 percent of disturbance arising from airplanes sounds (Whitelegg, 2004). Air fleet of Aseman Airline includes 4 Boeing 727, 12 Fokker 100, 6 A.T.R and 3 Falcon 20 airplanes. For example, noise level of Boeing 727 airplane is 704 decibel whenever flying and is 101.5 dB in flight condition (Thames, 2005). However, since Mehrabad airport in Tehran is in neighborhood of residential areas and most of the Aseman Airline flights except flights that their destination are countries in the sought margin of Persian Gulf, are performed from this airport, therefore, noise pollution arising from airplane has adverse effects in terms of mental and physical health of residents of inhabitative areas in neighborhood of airport. Regions such as Tehransar, Shahrak-e-azadi, Shahrak-e-farhangian, have been subject to the greatest effects.

DISCUSSION AND CONCLUSION

The maximum of water consumption of Aseman Airline in the year 2003 has been 5550 m³ during July until August and 2940 m³ during June until July of the year 2004 and peak point of water consumption has been 7500 m³ in the year 2005 and during August until September. Maximum of electricity consumption of Aseman Airline in the year 2003 has been 619600 kWh during July until September and 759300 kWh in the year 2004, during July until August and 622400 kWh in the year 2005, during July until August.

Maximum of natural gas consumption in Aseman Airline in the year 2003 has been 63490 m³ during December until January and in the year 2004, has been 83647 cubic meters during Feb. until March and in the year 2005, has been 79000 m³ during Dec. until Jan.

Also, 70 packages of paper tissue are bought daily and 2000 packages including 500 sheets in the size of A4 are bought monthly in Aseman Airline.

Origin of waste production is divided into two groups in Aseman Airline:

- 1- General waste produced in different parts of the company.
- 2- Solid waste returned from airplane.

In this company, averages of 661500 liters of fuel are consumed in this company's vehicles yearly.

In the last nine months of the year 2005, amount of 60263155 liters of airplane fuel has been consumed. Proposals for reducing water consumption include: Staff training for avoidance of excessive water consumption, assigning index of water consumption and controlling

water consumption according to the index, inspecting reasons of increasing in water consumption, using intelligent taps and using well water for irrigation of green space.

-Proposals for reducing electricity consumption include:

1- Replacing ordinary lamps with economical lamps, since, just in the service building of Aseman Airline, 180 florescent lamps are used and ordinary florescent lamp consumes 50 Watt of electricity power and its equivalent, economical lamps consumes 20 Watt of electricity power, therefore, replacing lamps of this building with economical lamp is 1.98 dollar, therefore 356 dollar will be cost of buying lamps and reduction of this cost company can save US \$ 15210 in electricity cost. (Cost of buying lamps in future years will be deducted from this amount) cost of consumptive electricity in a year has been achieved by using number of lamps multiplied by consumptive power of a lamp and cost of per watt (2 centime) and number of days of work (about 220 days in this company) and finally work hours (8 h in a day).

2- Other proposals include: Turning off the lamp of the rooms whenever leaving rooms, maximum usage of natural light specially around southern window, staff training for reducing electricity consumption, performing repairs and regular services for heating and cooling equipment, designing rooms and cooler channels, so that cool weather were distributed equally in all of the rooms of the company.

- Proposals for reducing paper consumption include: staff training, using e-mail, paper spin-off from other waste, and using both sides of a paper sheet .

- Proposals for reducing fuel consumption of vehicle include:

Not using of worn out vehicles, using gas as fuel in vehicles, technical inspection of vehicles regularly and using technologies for reducing fuel consumption.

- Proposals for reducing airplane fuel consumption:

To modernize Air traffic management, flight in optimal height, establishment incentive mechanism for pilots if he has economical fuel consumption, using a few engines for airplane movement on earth.

- Proposals for reducing pollution arising from airplane washing: Suitable peripheral design for airplane washing, prevention of swage dispersal, expelling swage according to environmental principles and using the method of dry washing in which , chemical materials and wax are used instead of water and no hog-wash isn't produced.

- Proposals for reducing noise pollution: Transferring all of the Flights from Mehrabad airport to the Emam Khomeini airport, correct selection of landing strip for landing and flying of airplane and not performing unnecessary flight during midnight until 6:00 A.M.

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